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WHAT IS CLAIMED IS:

1.   A method of controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising:

receiving data from said sensors of said engine for one or more measured or sensed parameters;

estimating a state of said engine by estimating one or more unmeasured or unsensed parameters using the data from said sensors and a predictive model of said engine; and

generating commands for said actuators based on said state using an optimization algorithm; and

transmitting said commands to said engine.

2.   The method of claim 1, wherein said step of estimating uses an Extended Kalman Filter.

3.   The method of claim 2, wherein said Extended Kalman Filter is adapted to correct a mismatch between said model and said engine.

4.   The method of claim 2, wherein said predictive model is a simplified real-time model.

5.   The method of claim 4, wherein said simplified real-time model is a non-iterating, analytic model.

6.   The method of claim 5, wherein said simplified real-time model is a non-linear model which can be linearized.

7.   The method of claim 1, wherein said predictive model is a simplified real-time model.

8.   The method of claim 7, wherein said simplified real-time model is a non-iterating, analytic model.

9.   The method of claim 8, wherein said simplified real-time model is a non-linear model which can be linearized.

10.   The method of claim 1, wherein said optimization algorithm is a quadratic programming algorithm adapted to optimize an objective function under a set of constraints.

11.   The method of claim 10, wherein said objective function is based on at least one of said unmeasured or unsensed parameters.

12.   The method of claim 11, wherein optimization algorithm uses a control horizon to optimize said objective function.

13.   The method of claim 12, wherein said control horizon is finite.

14.   The method of claim 12, wherein said control horizon is infinite.

15.   The method of claim 14, wherein optimization algorithm implements said infinite control horizon by approximating an infinite horizon tracking error.

16.   The method of claim 10, wherein at least one of said constraints is based on at least one of said unmeasured or unsensed parameters.

17.   The method of claim 1, wherein said step of generating commands includes simulating said engine in a model.

18.   The method of claim 11, wherein said model is a simplified real-time model.

19.   The method of claim 18, wherein said simplified real-time model is a linearized non-iterating, analytic model.

20.   A system for controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising:

a state estimator adapted to estimate a state of said engine by estimating one or more unmeasured or unsensed parameters using data from said sensors of said engine for one or more measured or sensed parameters, said estimator including a model of said engine; and

a control module adapted to generate commands for said actuators based on said state, said control module including an optimization algorithm for determining said commands.

21.   The system of claim 20, wherein said state estimator uses an Extended Kalman Filter.

22.   The system of claim 21, wherein said Extended Kalman Filter is adapted to correct a mismatch between said model and said engine.

23.   The system of claim 21, wherein said model is a predictive simplified real-time model.

24.   The system of claim 23, wherein said simplified real-time model is a non-iterating, analytic model.

25.   The system of claim 24, wherein said simplified real-time model is a non-linear model which can be linearized.

26.   The system of claim 20, wherein said model is a predictive simplified real-time model.

27.   The system of claim 26, wherein said simplified real-time model is a non-iterating, analytic model.

28.   The system of claim 27, wherein said simplified real-time model is a non-linear model which can be linearized.

29.   The system of claim 20, wherein said optimization algorithm is a quadratic programming algorithm adapted to optimize an objective function under a set of constraints.

30.   The system of claim 29, wherein said objective function is based on at least one of said unmeasured or unsensed parameters.

31.   The system of claim 30, wherein optimization algorithm uses a control horizon to optimize said objective function.

32.   The system of claim 31, wherein said control horizon is finite.

33.   The system of claim 31, wherein said contr0ol horizon is infinite.

34.   The system of claim 33, wherein optimization algorithm implements said infinite control horizon by approximating an infinite horizon tracking error.

35.   The system of claim 29, wherein at least one of said constraints is based on at least one of said unmeasured or unsensed parameters.

36.   The system of claim 20, wherein said control module is adapted to generate commands by simulating said engine in a model.

37.   The system of claim 36, wherein said model is a simplified real-time model.

38.   The system of claim 37, wherein said simplified real-time model is a linearized non-iterating, analytic model.